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Next-Gen Sequencing & Multi-Omics Data Analysis Internship with Project Work

Start Date
5th May 2025

Time: 7:00 PM
8:00 PM IST
(Live Online Sessions)

Duration: 30 Days Training + 2 Months project work

Online Internship + Hands-on Project Work

Internship Completion Project Experience Certificate

toll free 1800-1200-1818 or 080-5099-7000

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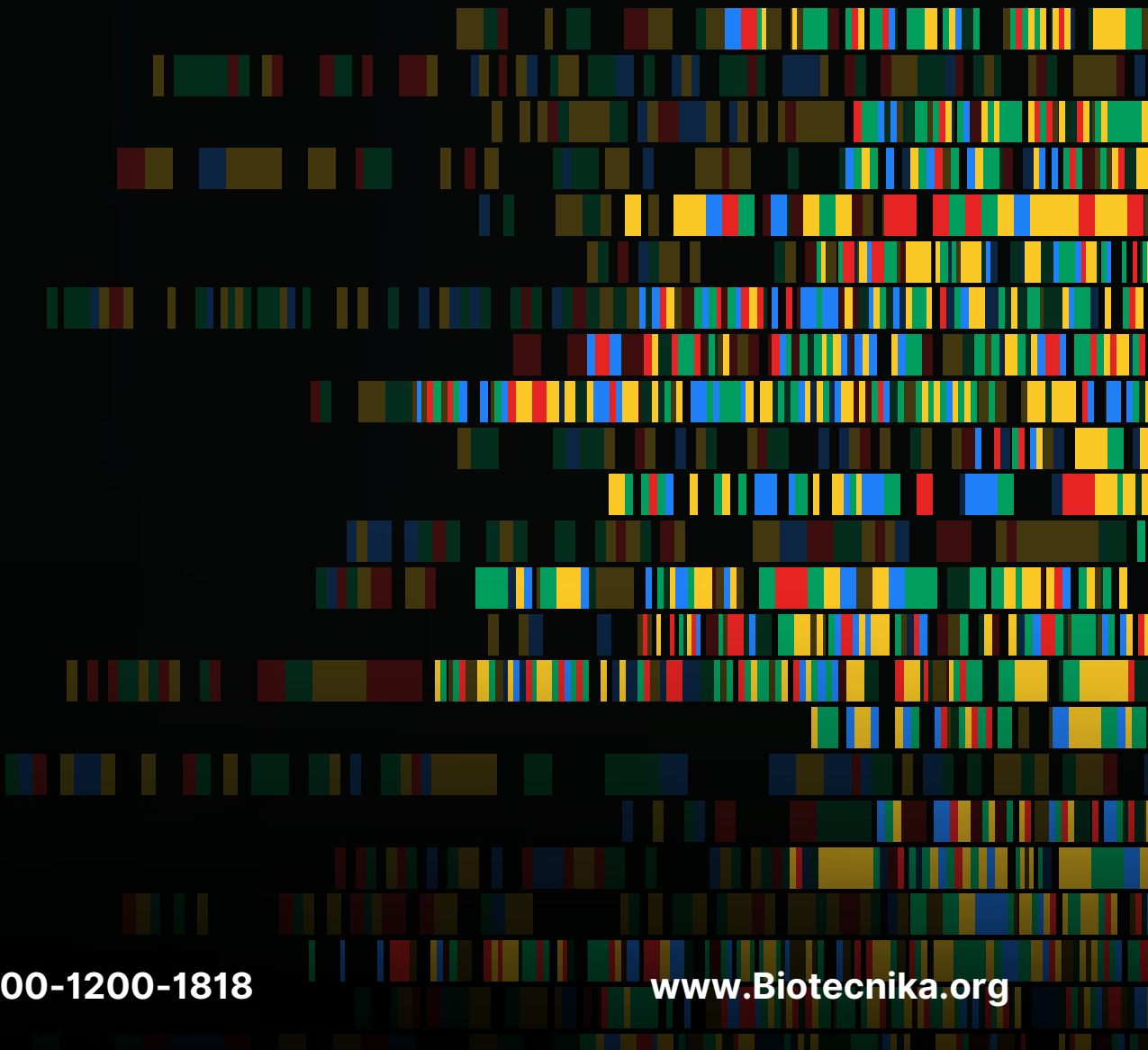
About the Internship

This hands-on internship program is designed for students, researchers, and professionals aiming to build expertise in Next-Generation Sequencing (NGS) and multi-omics data analysis. Through structured training modules, live demos, and real-data projects, participants will gain practical skills essential for careers in genomics, transcriptomics, metagenomics, and related fields.



Eligibility

This program is suitable for:

- Undergraduate and postgraduate students from Life Sciences, Biotechnology, Bioinformatics, Microbiology, Genetics, and allied fields
- Research scholars, PhD students, and academic faculty
- Industry professionals and job seekers in genomics and bioinformatics

Anyone looking to gain hands-on experience in NGS data analysis with real-world projects

No prior coding experience is mandatory, but basic familiarity with biology is recommended.

Detailed Curriculum

Module I: Introduction & Fundamental Concepts

Day 1: Orientation and Introduction to NGS

- Principle & Importance
- Historical context and evolution from Sanger sequencing
- Comparison with traditional sequencing methods

Day 2: NGS Workflow

- Library preparation, sequencing, and data analysis
- Library preparation steps: DNA fragmentation, adapter ligation, amplification
- Quality control measures

Day 3: NGS Platforms

- Overview of platforms: Illumina, Ion Torrent, Pacific Biosciences
- Read lengths, throughput, and applications
- Platform selection criteria

Day 4: Library Preparation Techniques

- Techniques for DNA, RNA, ChIP samples
- Protocols for whole-genome, RNA-seq, ChIP-seq libraries
- Troubleshooting and common challenges

Day 5: Introduction to Linux & Python/R

- Linux command-line basics
- Python/R scripting basics and data handling practice

Module II: Preprocessing, Alignment, Data Formats & Variant Calling

Day 6: Manipulation of Linux & Python/R in NGS Data Analysis

- Manipulation of Linux & Python/R in NGS Data Analysis
- Basic Linux commands and scripting
- Python/R basics for bioinformatics (Bioconductor, variables, loops)

Day 7: Data Formats & QC

- FASTQ, BAM, SAM, BED, VCF
- Phred quality scores, FastQC, MultiQC

Day 8: Adapter Trimming & QC

- Trimming algorithms: Trimmomatic, Cutadapt
- Adapter contamination handling

Day 9: Read Alignment

- BWA, Bowtie2, BWA-MEM
- Alignment to reference genomes (hg19, hg38)

Day 10: Sorting and Indexing

- SAM/BAM flags
- Sorting and indexing with SAMtools

Day 11: Variant Calling, Annotation and Filtering

- SNVs, indels, VCF format, annotations (QUAL, DP), filtering

Day 12: Practical on Variant Calling

- Filter VCF with bcftools
- Annotation with VEP, Varsome

Module III: Gene Expression Analysis

Day 13: RNA-Seq Introduction

- Transcript quantification and differential expression

Day 14: RNA-Seq Data Preprocessing

- Practical: Demo on data preprocessing

Day 15: RNA-Seq Alignment

- Practical: Align reads using STAR aligner

Day 16: Count Matrices

- Generate gene-count matrices
- Normalization techniques: TPM, RPKM

Day 17: Practical on Count Matrix Generation

- FeatureCounts

Day 18: Differential Expression Analysis

- DESeq2/edgeR, fold change, p-value adjustment

Day 19: Practical on DEG Identification

- Run DESeq2 on count matrix

Day 20

- Practical on DEG Visualization and Reporting

Module IV: Applications of NGS

Day 21: NGS in Cancer, Genetics and Microbial Genomics

- Applications in oncology, rare diseases, and microbial genomics

Day 22: NGS in Drug Discovery and Clinical Settings

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Day 23: CRISPR-Cas9 Genome Editing

- In silico guide design using CHOPCHOP, CRISPOR
- Visualization of off-targets

Day 24: NGS in Agriculture

- Genomic breeding, disease resistance, microbiome analysis

Module V: Cloud-Based NGS Analysis

Day 25: Galaxy Server Demo

- Introduction to cloud-based NGS analysis
- Practical: RNA-seq walkthrough

Day 26: Single-Cell RNA-Seq Analysis and Demo

- Basics of scRNA-seq, dimensionality reduction (PCA, UMAP)
- Practical: scRNA-seq workflow on Google Colab

Day 27: 16S Metagenomic Analysis

- QIIME2, Kraken2, MetaPhlAn
- Practical demo with sample data

Day 28: Epigenomics Analysis

- Practical: Demo using Google Colab

Module VI: Exploring the Future – Prospects, Challenges, Ethics, Regulations and Career Guidance

Day 29: Future Directions, Challenges and Ethical Considerations

- Emerging trends (e.g., long-read sequencing, spatial transcriptomics)
- Ethics and regulatory frameworks (HIPAA, GDPR, FDA)

Day 30: Career Scope of NGS

- Opportunities in India and abroad
- Career counselling, research and industry prospects

2 Months Project Work

Participants will work on one or more of the following projects, guided by experts. All projects involve real datasets and will culminate in deliverables for portfolio building.

1. Variant Calling Pipeline

- Dataset: 1000 Genomes Project
- Tools: FastQC, BWA, GATK, bcftools
- Deliverables: Cleaned BAM file, Filtered VCF, Report

2. RNA-Seq Differential Expression

- Dataset: GEO (e.g., GSE12345)
- Tools: STAR, featureCounts, DESeq2
- Deliverables: Count matrix, Volcano plot, DEGs report

3. ChIP-Seq Peak Calling

- Dataset: ENCODE (CTCF in HeLa)
- Tools: MACS2, IGV
- Deliverables: BED file, IGV snapshot, Summary

4. Single-Cell RNA-Seq Clustering

- Dataset: 10x Genomics PBMC
- Tools: Scanpy (Python), Seurat (R)
- Deliverables: UMAP plot, Marker genes, Interpretation
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5. Metagenomic Taxonomic Profiling

- Dataset: Human Microbiome Project
- Tools: Kraken2, Bracken, Krona
- Deliverables: Taxonomic table, Krona chart, Diversity report

6. Functional Annotation of a Novel Genome

- Dataset: Assembled contigs (FASTA, NCBI)
- Tools: Prokka, BLAST, InterProScan
- Deliverables: GFF file, Functional table, Annotation summary

7. miRNA Expression Analysis

- Dataset: GEO (e.g., GSE266440)
- Tools: edgeR, limma, RStudio
- Deliverables: Heatmap, Significant miRNAs, Summary

8. Pathway Enrichment of DEGs

- Dataset: RNA-Seq DEGs or TCGA
- Tools: DAVID, GSEA, Enrichr
- Deliverables: Enrichment tables, Pathway plots, Interpretation

9. Protein-Ligand Docking Simulation

- Dataset: PDB structure, PubChem ligand
- Tools: AutoDock Vina, PyMOL
- Deliverables: Docking poses, Visualizations, Report

10. Comparative Genomics of Bacterial Strains

- Dataset: NCBI genomes
- Tools: Roary, MAUVE, OrthoFinder
- Deliverables: Core/accessory genes list, Alignment map, Functional summary

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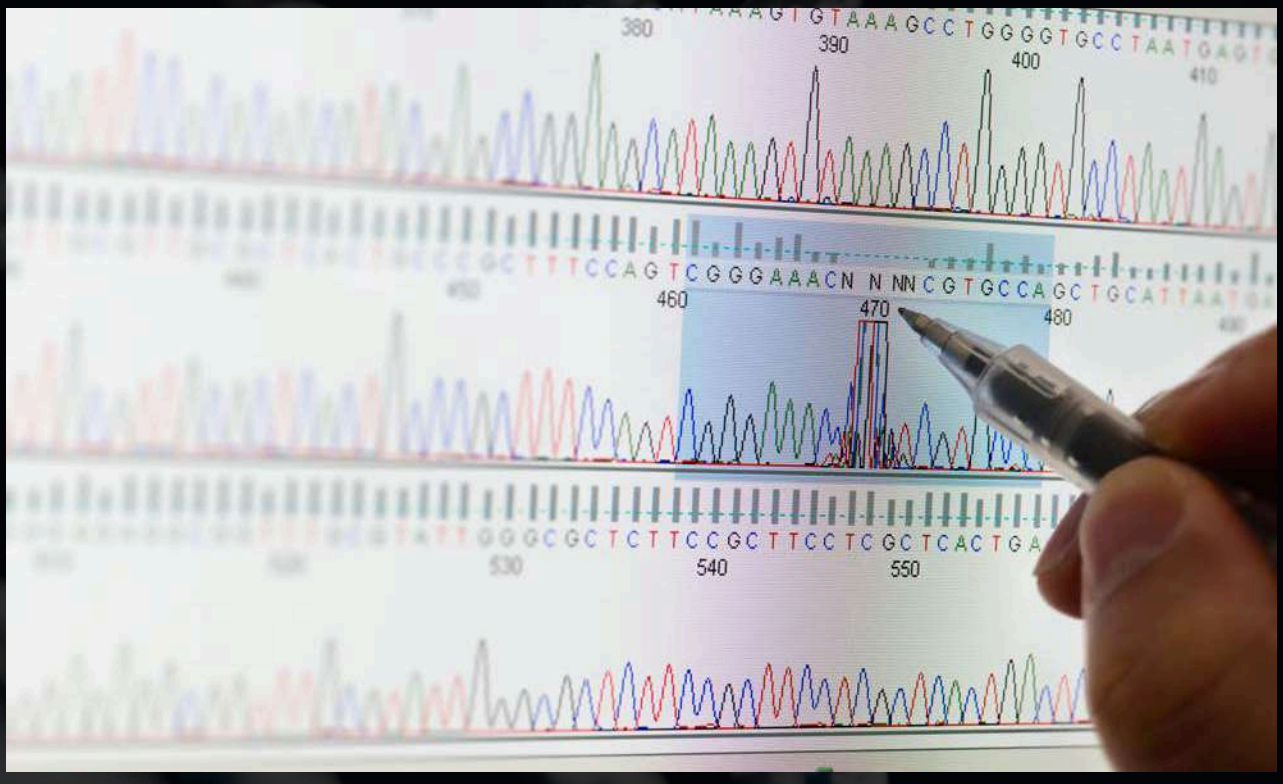
Why Join This Internship?

- Real-World Skill Development: Learn to analyze DNA/RNA sequencing data using industry-relevant tools and workflows
- Hands-On Projects: Work on real datasets with deliverables to showcase in your resume or academic portfolio
- Expert Mentorship: Sessions led by experienced trainers and bioinformatics professionals
- Career Guidance: Learn how to position your NGS skills for research and high-paying biotech roles
- Flexible Learning: Access session recordings and complete your project work at your own pace
- Recognized Certification: Get certified with Internship + Project Work credentials to boost your academic or career profile

Key Benefits

- 30+ hours of live instruction with recordings
- 10 optional mini-project tracks with datasets and tools
- Certification for internship + guided project work
- Access to open-source and cloud platforms
- Doubt-clearing support and guidance
- Resume-building assets including visual reports and project files



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Career Prospects After Completing the Internship

With the rapid adoption of next-generation sequencing (NGS) technologies across research, clinical diagnostics, agriculture, and pharmaceutical sectors, skilled professionals in NGS and multi-omics data analysis are in high demand. Completing this internship equips you with the technical knowledge and practical experience needed to qualify for diverse and high-impact roles.

Top Job Roles You Can Target

- NGS Data Analyst
- Bioinformatics Scientist / Analyst
- Genomics Research Associate
- Computational Biologist
- Transcriptomics Data Scientist
- Cancer Genomics Researcher
- Clinical Genomics Analyst
- Molecular Biology Data Specialist
- NGS Application Scientist (Industry/Diagnostics)
- Single-Cell Bioinformatician
- Microbiome Data Analyst
- **Agrigenomics Researcher**

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Top Companies Hiring in India

MEDGENOME

strand
New Generation Healthcare

NBMG

SciGenom

Genotypic
genomics simplified

mapmygenome.in™
Know Yourself

TATA MD

xcelris™
WE MAKE DNA SPEAK

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10x GENOMICS

ThermoFisher SCIENTIFIC

BROAD INSTITUTE

QIAGEN

Pfizer

Stanford University

NOVARTIS

AstraZeneca

Oxford NANOPORE Technologies

Genentech
A Member of the Roche Group

Massachusetts Institute of Technology

NIH
National Institutes of Health

HARVARD UNIVERSITY

Industries Hiring NGS Professionals

- Biotechnology & Pharmaceutical R&D
-
- Hospitals & Clinical Diagnostic Labs
- Precision Medicine & Oncology Research Centers
- Agricultural Genomics Firms
- Microbiome & Metagenomics Startups
- Academic Research Institutes
- Genomic Software & Bioinformatics Service Providers

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Course Instructors

Dr. Nilofer K Shaikh

With a strong background in big data analysis using computational approaches in cancer omics data, Ms. Nilofer K Shaikh brings a wealth of experience from MIT ADT University. Her expertise spans cancer research, drug design, molecular dynamics simulation, data mining, and various omics technologies. Proficient in Python, R, and computational methodologies, she has a deep understanding of genomics, metabolomics, proteomics, transcriptomics, pharmacogenomics, and AI for cancer treatment. Her skillset also includes machine learning, MySQL database management, and natural language processing (NLP)

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Course Instructors

Dr. Elamath

Dr. Elamathi Natarajan is a dedicated bioinformatician with a robust background in computational biology, data analysis, and genomics. Holding a Doctorate in Bioinformatics from Dr. A.P.J Abdul Kalam Technical University and an MBA in Information Systems Management, she has made significant contributions to the field through both research and teaching.

she has served as an Assistant Professor and Head of Department (HOD) In-Charge at Kalinga University, Raipur, where she excelled in lecturing, research, and departmental management. At Biotecnika Info Labs Pvt Ltd, Bangalore, she played a key role in academic support, enhancing student success through coaching and program development.

Elamathi's expertise includes developing bioinformatics pipelines, conducting quality assessments, and applying machine learning algorithms to genomics data. Recognized for her work, including a Senior Research Fellowship from the Indian Council of Medical Research (ICMR), she continues to drive innovation in bioinformatics and is seeking a new challenge to further advance scientific discoveries.

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Course Instructors

Mrs. TithSaha

Tithi Saha is a seasoned educator and life sciences expert with a strong academic and research background in Biotechnology. She holds a Master's degree in Biotechnology from the prestigious Nirma University, Ahmedabad, and successfully qualified the CSIR-NET examination in 2009, a testament to her academic excellence and deep subject understanding. She has also been a Gold Medallist of her batch. She began her academic career as an Assistant Professor at Guru Ghasidas Vishwavidyalaya, Bilaspur, where she played a pivotal role in teaching and mentoring students in core areas of life sciences. For the past 10 years, she has been an integral part of Biotecnika, one of the most trusted platforms for life sciences education and research training in India and currently working as Category Head of Competitive Exams.

With over a decade of teaching and mentoring experience, her areas of expertise include Genetics, Molecular Biology, Molecular Tools, and Evolution. She is known for her clarity of concepts, structured teaching approach, and her ability to make complex topics both engaging and accessible to students. Passionate about nurturing the next generation of scientists, she continues to inspire thousands of GATE, CSIR-NET, and life sciences aspirants across the country.

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Course Instructors

Mrs. Urmimala Ray

Urmimala Ray is an experienced academic professional & a valuable mentor in the field of Biotechnology and Life Sciences Education, with a Master's degree in Biotechnology from Garden City College, affiliated with Bangalore University.

With almost 15 years of teaching experience, Urmimala has passionately trained, mentored, and facilitated the academic journeys of B.Sc, M.Sc Life Sciences students, as well as CSIR NET, GATE, and DBT aspirants. Currently serving as a Category Head of BioIT department and Academic Specialist at Biotecnika she remains committed to guiding students toward academic excellence and competitive exam success.

Throughout her career, she has supervised and guided numerous college-level research projects, instilling research aptitude and scientific thinking in students. She has also been actively involved in college admission camps, academic promotion consortiums, and has co-organized college-level events, national conferences, symposiums, science exhibitions, and job fairs. She has also provided career guidance and mentorship to numerous students, helping them make informed decisions about higher education, research opportunities, and industry roles in the biosciences domain

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Course Instructors

Dr. Tanushree Saxena

Dr. Tanushree Saxena is an accomplished expert in Genetics, Molecular Biology, and Research Techniques, with a Ph.D. in Biotechnology. She brings over 9 years of teaching experience and 5 years of hands-on research expertise to her current role as Category Manager – Clinical Research & Allied Fields and Academic Support Specialist at Biotecnika.

Her academic journey includes a significant research tenure at the Birla Institute of Scientific Research (BISR), a sister concern of BIT Mesra, Ranchi, where she contributed t

to various research projects, authored scientific publications and book chapters, and mentored postgraduate and undergraduate students in dissertations and training programs. Dr. Saxena has also served as a lecturer and guest faculty across several reputed institutions. A recipient of the prestigious DAAD Fellowship, she attended a summer school at Leibniz University, Hannover, Germany.

She has consistently topped her classes, securing top ranks in her Ph.D. coursework, postgraduate Biotechnology, and undergraduate Botany. Her academic brilliance is further highlighted by multiple awards for oral and poster presentations at national and international conferences.

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Course Instructors

Mrs. Somrita Pal

Somrhita Pal holds a M.Sc. and B.Ed., along with NET qualification, and has been actively involved in academics for over 11 years, specializing in Cell Biology, Genetics,and Plant Biotechnology.

A Master's from Calcutta University, she began her teaching career as a lecturer at the college level, where she served for five yearsbefore joining Biotecnika. She has also served as an instructor in a UGC-sponsored National Workshop on Mushrooms Cultivation.

Her research contributions include publications in both national and international platforms, such as MDPI's Journal-Agriculture and Science and Culture, with a focus on plant regeneration, morphogenesis, and sustainable agriculture. Her professional philosophy is deeply rooted in the belief that gathering knowledge is a passion, and spreading it is a devotion.

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Course Instructors

Mrs. Divya S.

With a strong academic foundation in plant biotechnology and molecular biology, Ms.Divya S. holds over two years of research and mentoring experience from the University of Kerala, where she guided both postgraduate and undergraduate students through their dissertation work.

Her expertise lies in plant tissue culture, molecular techniques, and gene expression analysis. She secured an All India Rank of 20 in the CSIR NET Life Sciences examination in 2018. For the past six years, she has been contributing as an AcademicSupport Specialist at Biotecnika, helping students and researchers excel in competitiveexams and research domains within the life sciences.

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Course Instructors

Dr. Suchitra Singh

Dr. Suchitra Singh is an accomplished bioinformatics scientist and Postdoctoral Fellow (Raja Jwala Prasad Fellowship) at the Department of Anatomy, Banaras Hindu University. With a Ph.D. in Bioinformatics from the Central University of South Bihar, Dr. Singh has spent the past several years deeply engaged in advanced research focused on computer-aided drug design (CADD), molecular dynamics simulation, and Next Generation Sequencing (NGS) data analysis including WES, WGS, RNA-Seq, metagenomics, and targeted panel sequencing.

Her postdoctoral work focuses on oncogenic targets in cancer, where she not only designs and optimizes computational pipelines for NGS data but also contributes to translational cancer research. Previously, she has worked as a Research Scholar in the field of oral cancer bioinformatics and as a Junior Research Fellow analyzing transcriptomic datasets of Musa paradisiaca.

Dr. Singh is proficient in multiple programming languages and bioinformatics tools including Python, R, Shell scripting, Gromacs, AutoDock, HISAT2, GATK, and more. She has published extensively in peer-reviewed international journals such as Journal of Cellular Biochemistry, Microbes and Infection, and Molecular Diversity, and has presented her research at several prestigious conferences across India.

As a Course Instructor for the NGS Hands-on Training Program at Biotecnika, Dr. Singh brings her strong research background and practical experience to the forefront, training students and professionals in essential NGS techniques, pipeline development, and data interpretation. Her sessions are designed to bridge the gap between academic learning and industry-ready skills, helping participants confidently handle real-world biological datasets and contribute meaningfully to genomics and drug discovery research.

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